



# MANUAL

## **Series 36 & 38 GEAREDUCERS®**

RM-36 & 38F



### *Field Repair Instructions*

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Manual 92-1419

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FIELD REPAIR — SERIES 36 & 38 GEAREDUCERS

# MARLEY

## Series 36 & 38 Geareducers

### Field Repair Instructions

Marley recommends that Geareducers in need of extensive repair be returned to its plant at Olathe, Kansas in exchange for a factory reconditioned unit. Obtain "Customer Return Material" tag from Marley sales office or representative to affix to the Geareducer for return. A factory reconditioned Geareducer carries the same one year guarantee against defects in material and workmanship as does a new unit.

Geareducers can be repaired in the field, however, major repairs require the use of a fully equipped machine shop. When field repair or replacement of parts is necessary, the following procedure is recommended for the disassembly and assembly of the unit.

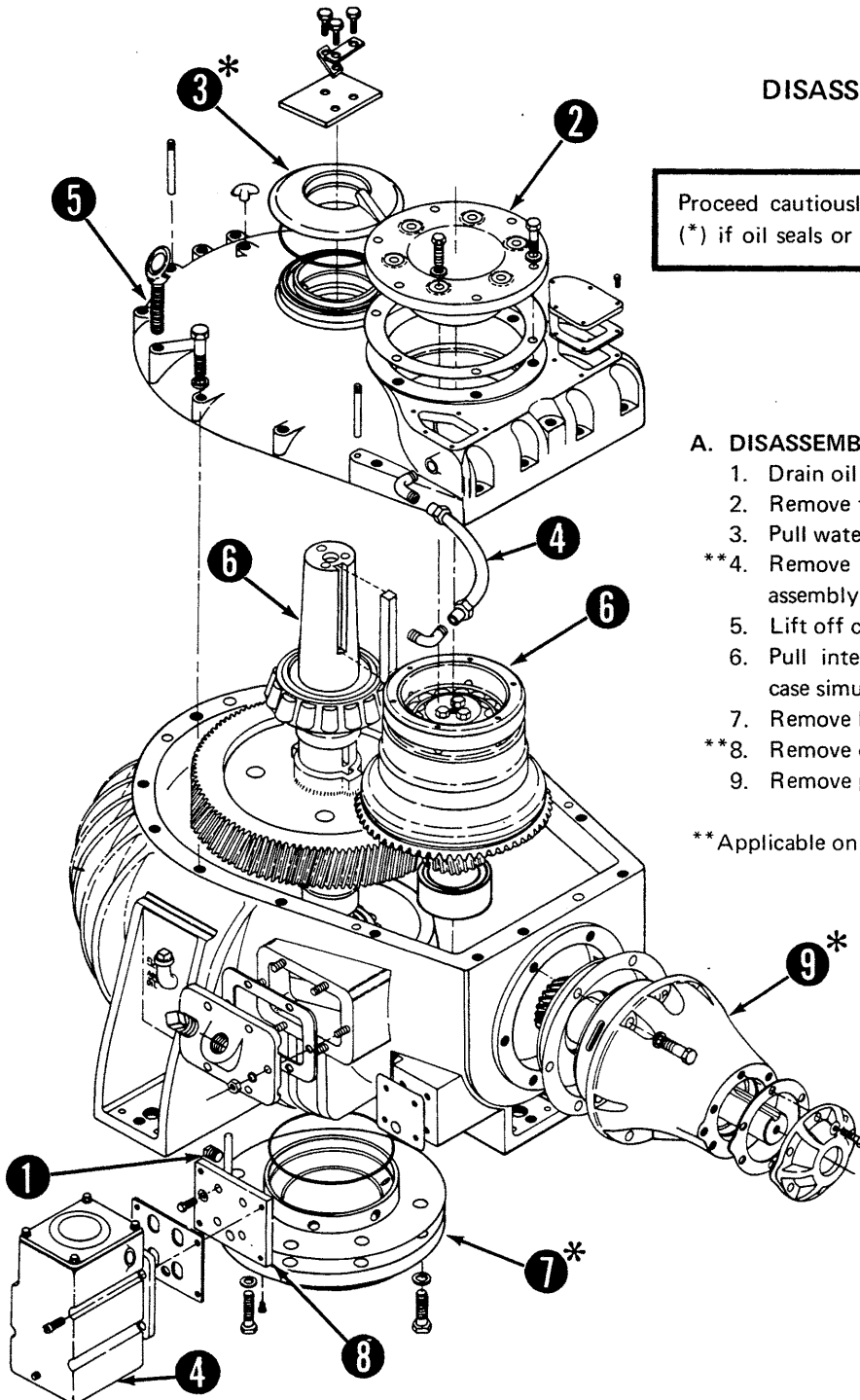
#### DISASSEMBLY OF GEAREDUCER

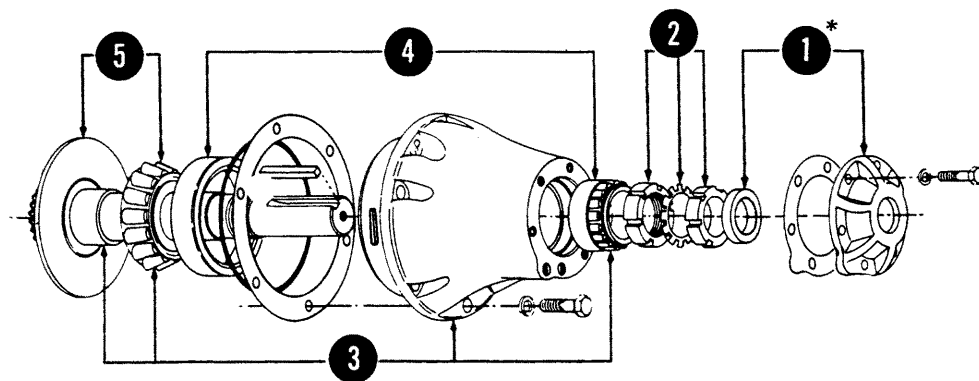
Proceed cautiously when removing parts noted by asterisk (\*) if oil seals or "O" rings are to be reused.

#### A. DISASSEMBLY OF MAJOR SUBASSEMBLIES

1. Drain oil by removing drain plug.
2. Remove top interstage cap.
3. Pull water slinger off fan shaft.\*
- \*\*4. Remove oil supply tube, plugs, and filter case assembly.
5. Lift off case cover.
6. Pull interstage and fan shaft subassemblies out of case simultaneously.
7. Remove lower fan shaft cap.\*
- \*\*8. Remove oil return assembly.
9. Remove pinion cage subassembly.\*

\*\* Applicable only to units having oil filters.

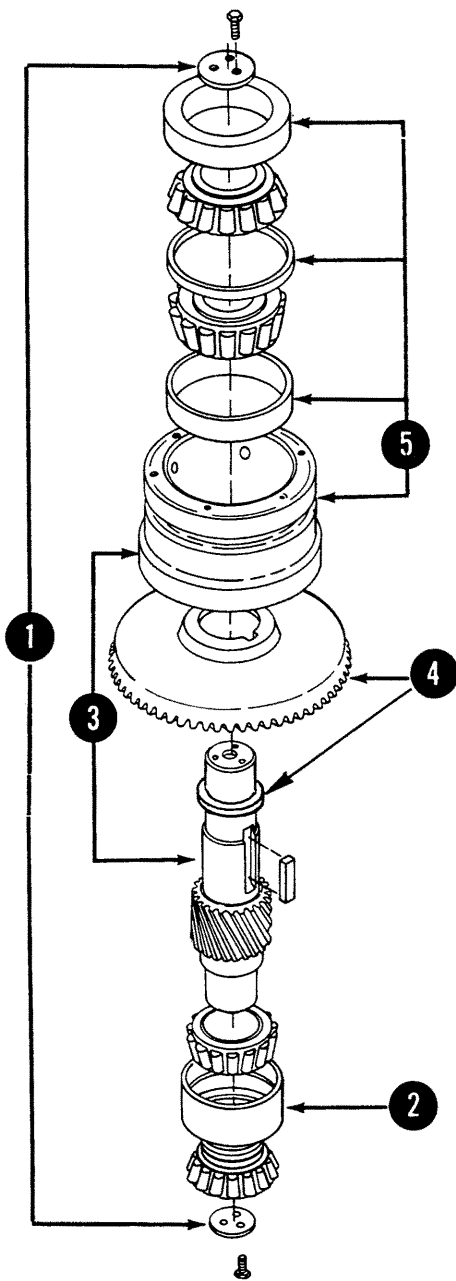




#### B. DISASSEMBLY OF PINION CAGE

1. Remove pinion cage cap.\*
2. Remove locknuts and washer from pinion shaft.
3. Press pinion shaft with head bearing cone out of pinion cage. (This will free cone of tail bearing.)
4. Remove bearing cups from pinion cage.
5. If bearing cone on head of pinion shaft is to be replaced, it will be necessary to press off oil slinger and bearing cone at the same time.

\*See page 2.



#### C. DISASSEMBLY OF INTERSTAGE

1. Remove top and bottom interstage bearing discs.
2. Pull bottom bearing, two cones with spacer and one cup, from shaft.
3. Push shaft out of upper bearing and retainer.
4. Remove spiral bevel ring gear and spacer from shaft. Spacer furnished on all Series 38 Geareducers and Series 36 with 9.64 and 10.83 ratio.
5. Pull upper bearings from top interstage retainer.

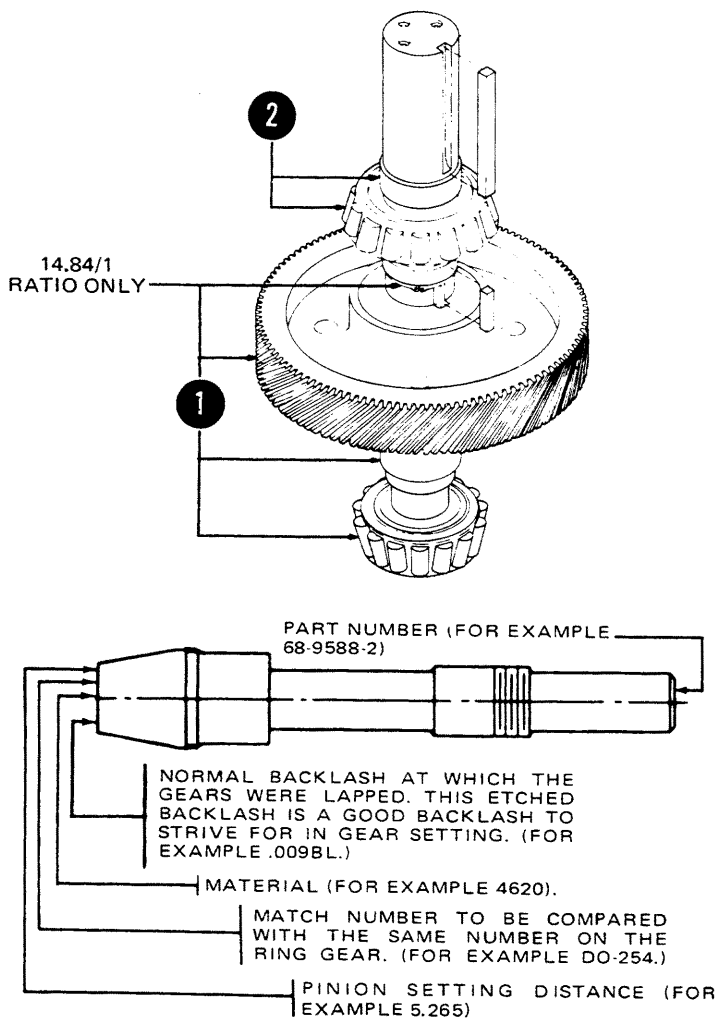


Figure 1. Gear Match Numbers & Setting Data

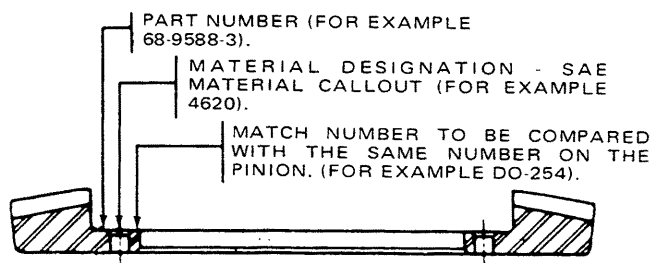
#### D. DISASSEMBLY OF FAN SHAFT

1. Press helical ring gear, lower fan shaft spacer and lower cone from shaft. Remove key spacer ring (14.84/1 overall ratio only).
2. Remove upper bearing cone and water slinger spacer.
3. Remove upper fan shaft bearing cup from case cover.
4. Remove lower fan shaft bearing cup from case (not illustrated.)

#### ASSEMBLY OF GEAREDUCER

##### GEAR MATCH NUMBERS & SETTING DATA

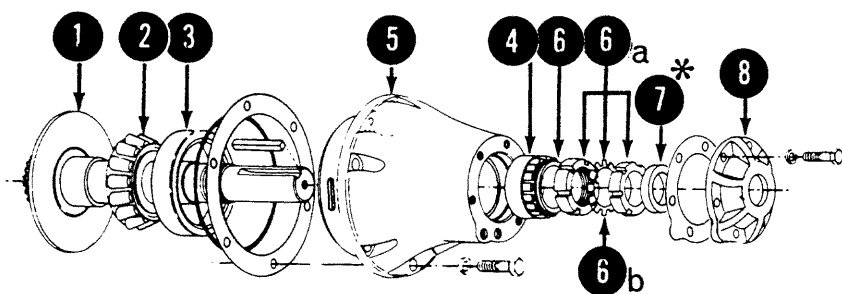
Before assembling a new pinion gear in the pinion cage, check match numbers on pinion gear and spiral bevel ring gear to be certain that they are a matched set. Gears are lapped in matched sets at the factory and should not be separated. Numbers are etched on both the pinion and ring gear as illustrated in Fig. 1.



5.269 IS THE THEORETICAL PINION SETTING DISTANCE. THE ACTUAL PINION SETTING DISTANCE IS ETCHED ON THE END OF THIS PINION. THIS IS THE DISTANCE THE END OF THE PINION SHOULD BE FROM THE CENTER LINE OF THE RING GEAR SHAFT.

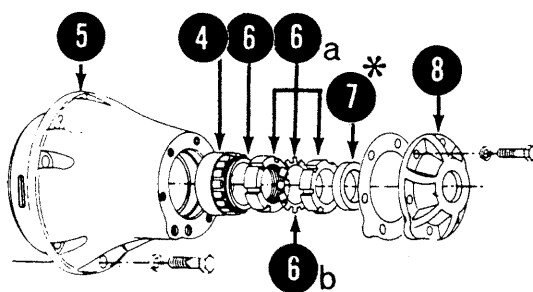
\*Marley recommends that new oil seals, "O" rings and gaskets be installed during a major overhaul. If oil seals, "O" rings or gaskets are to be reused, they should be carefully inspected for damage before being reinstalled.

Figure 1.A Wear Sleeve Item 7 Shown

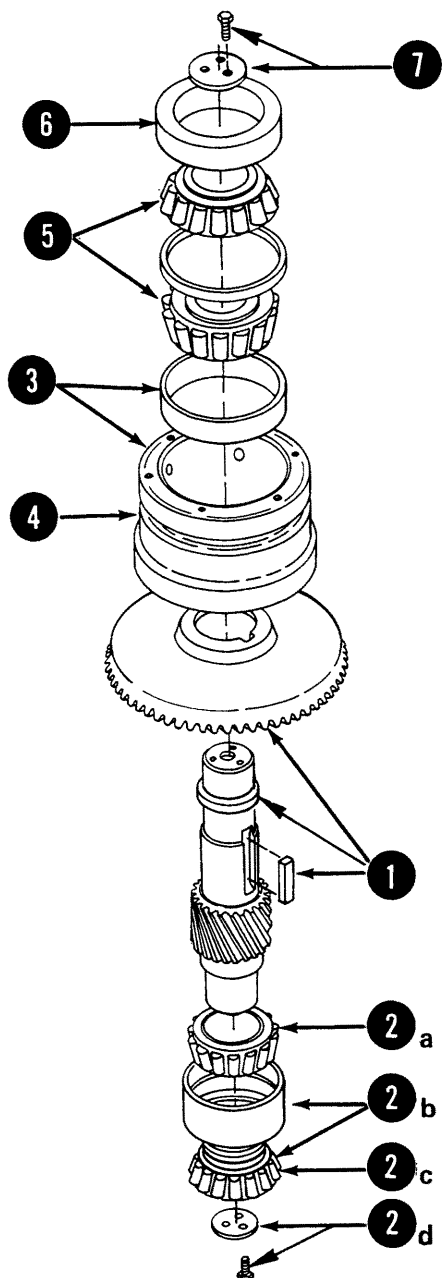


#### A. PINION CAGE ASSEMBLY

1. Press oil slinger onto pinion shaft.
2. Install pinion head bearing cone on pinion shaft pushing tight against shoulder.
3. Press pinion head bearing cup into pinion cage.
4. Press pinion tail bearing cup into pinion cage.
5. Lower pinion cage over pinion shaft until head bearing cone mates with cup.
6. Press tail bearing cone onto pinion shaft.
  - (a) Lock with locknuts and lockwasher to provide bearing preload of 10-18 inch pounds (resistance



- to rotation of pinion shaft.)
- (b) Crimp ears of lockwasher to locknuts after obtaining proper preload.
7. Series 36 Geareducers furnished prior to 1973 have a pinion shaft wear sleeve. If the wear sleeve is being replaced, press the wear sleeve onto the pinion shaft.
8. Install pinion shaft oil seal in pinion cage cap. Protect oil seal from damage when installing over keyway in pinion shaft. (See Marley Oil Seal Service Manual.)
9. Assemble pinion cage cap to pinion cage with gasket.



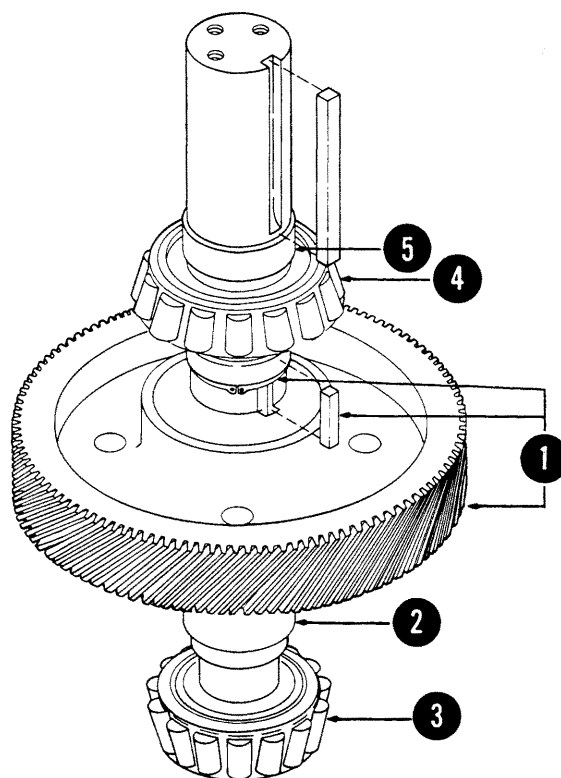
## B. INTERSTAGE ASSEMBLY

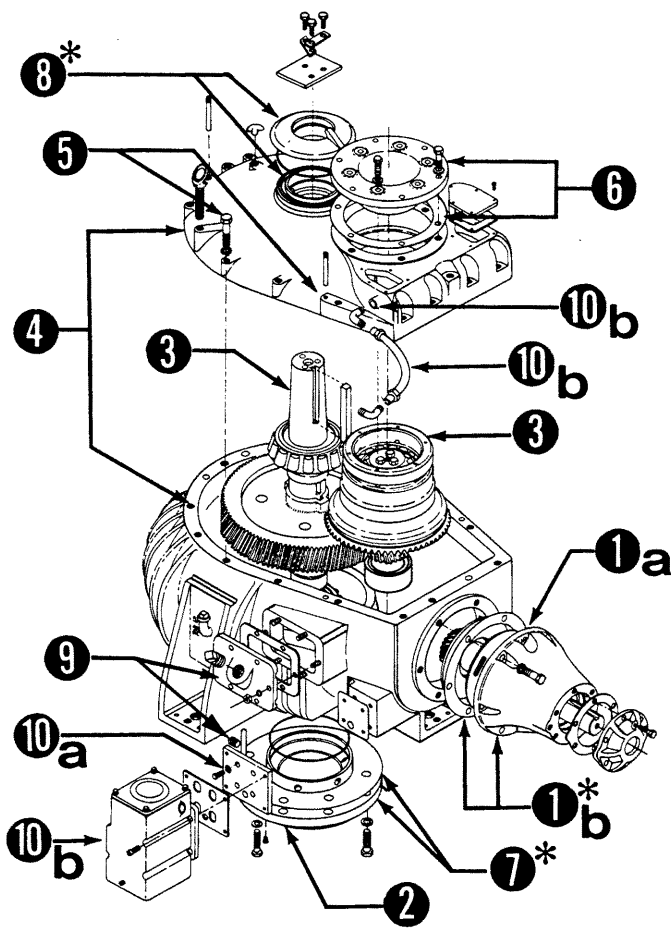
1. Install spiral bevel ring gear spacer against top of helical pinion. Spacer is used on all Series 38 Geareducers and Series 36 with 9.64 and 10.83 ratio. Install key and spiral bevel ring gear on interstage shaft.
2. (a) Press top cone of bottom interstage bearing onto interstage shaft.  
(b) Install double cup and spacer of bottom interstage bearing.  
(c) Press bottom cone into place.  
(d) Install disc with place bolts. (Tighten to 50-55 ft. lbs. torque.)
3. Press lower cup of upper interstage bearing into retainer.
4. Lower retainer over interstage shaft.
5. Press upper bearing cones onto shaft.
6. Press upper cup and spacer into retainer.
7. Install disc with place bolts (tighten to 140-150 ft. lbs. torque.)

## C. FAN SHAFT ASSEMBLY



1. Install key spacer ring (14.84/1 overall ratio only). Install key and press helical gear on fan shaft.
2. Place lower bearing spacer on fan shaft.
3. Press bottom bearing cone onto fan shaft.
4. Press upper bearing cone on fan shaft.
5. Install water slinger spacer.





\*See page 2.

#### CASE AND COVER ASSEMBLY (Not illustrated)

1. (a) Install upper fan shaft bearing cup in case cover.
- (b) Install lower fan shaft bearing cup in case.

#### FINAL ASSEMBLY

1. (a) Install "O" ring onto pinion cage subassembly.
- (b) Bolt pinion cage subassembly to case and cover subassembly using proper number of shims to give indicated pinion setting distance which is etched on front face of pinion gear. (See Figure 1, page 4.)
2. Temporarily install lower fan shaft cap and secure to case with cap screws. Leave a minimum of 1/8" clearance between cap and case. Do not install "O" rings or shims at this time.
3. Lower fan shaft and interstage shaft subassemblies into case simultaneously.  
Engage marked spiral bevel ring gear teeth with marked spiral bevel pinion tooth.
4. Apply a coat of Permatex No. 2 to surface of case which mates with case cover.  
Lower case cover subassembly onto case, piloting both shaft subassemblies into their respective bores.
5. Install dowel pins to align bearing bores. Fasten case cover to case with cap screws tightening to 70-75 ft./lbs. torque.
6. (a) Position top interstage cap shims and install cap

with place bolts.

- (b) Adjust shims to give proper backlash (.007-.009 normal) between spiral bevel gears. See "GEAR SETTING PROCEDURE".
7. Fan Shaft bearings must be preloaded to .001"-.003" in the following manner:

- (a) Assemble fan shaft subassembly in case-cover initially with a quantity of shims between case and bottom cap to insure that axial bearing end play exists.
- (b) Mount a dial indicator to measure axial movement of fan shaft. Support indicator stand on the cover or interstage cap adjacent to fan shaft and position indicator to read on machined top surface of fan shaft.
- (c) Rotate fan shaft slowly in one direction until all downward movement stops. Rotation is necessary in order to align the bearing rollers and seat roller ends on cone lip. Record dial indicator reading or zero the indicator.
- (d) Move shaft in opposite axial direction by either lifting on shaft by attaching to the shaft with a swivel joint and hoist or by turning Geareducer over allowing the weight of the shaft assembly to seat the bearings. If a hoist is used, lifting force should be 800 lbs. This is sufficient to overcome the weight of the fan shaft assembly. Rotate shaft slowly in one direction until all axial movement stops. Record dial indicator reading.
- (e) The difference in dial indicator readings (steps c and d) is the initial fan shaft bearing end play. In order to achieve the prescribed preload of .001" to .003", remove an amount of shims from between the case and bottom cap equal to the measure end play plus .001" to .003". For example, if the measured end play is .005", remove a total of .006" to .008" shim thickness.

Caution: If Geareducer is in the upright position when bottom cap is removed, block under the ring gear to prevent gear from dropping down onto lower interstage bearing retainer (roller cage).

- (f) Install "O" ring in bottom cap and install bottom cap. Tighten cap screws to 75-80 ft./lbs. torque.
8. (a) Coat labyrinth recess in case cover with Permatex No. 2 and install labyrinth ring.
- (b) Fill grooves of labyrinth ring and water slinger with a lithium-base grease of NLGI No. 2 consistency.
- (c) Install water slinger and its "O" ring on fan shaft.
9. Install inspection cover, gasket, and drain plug.
10. FOR ASSEMBLY WITH INTEGRAL OIL FILTER
  - (a) Install oil return assembly with gasket into case. If cap screws are black socket head, tighten to 30-35 ft./lbs. torque. If stainless steel socket head cap screws are used, tighten to 20 ft./lbs. torque.
  - (b) Install oil filter case assembly. Tighten cap screws to 35-40 ft./lbs. torque. Install oil supply lines and fittings.
11. FOR ASSEMBLY WITHOUT OIL FILTER (not illustrated)  
Install oil return cover with gasket. Install pipe plug in oil supply opening in case cover.

## GEAR SETTING PROCEDURE

The proper mounting of the gear set is essential to obtain long life and smooth operation of the gears. The pinion cage position adjustment is obtained by shims under the flange of the pinion cage. Shims are placed under the top interstage bearing cap to adjust ring gear position. The gear setting may require several attempts before obtaining the proper backlash and tooth contact pattern.

The gear and pinion are match-marked when lapped and must be assembled the same way. The ring gear has the end of two teeth marked "X" and the pinion has one tooth so marked; the gears should be engaged with the X-marked pinion tooth between those marked on the ring gear. Match marks can be checked through the inspection opening.

With the marked teeth of the gear engaged, check backlash with dial indicator (see Fig. 2). The indicator can be

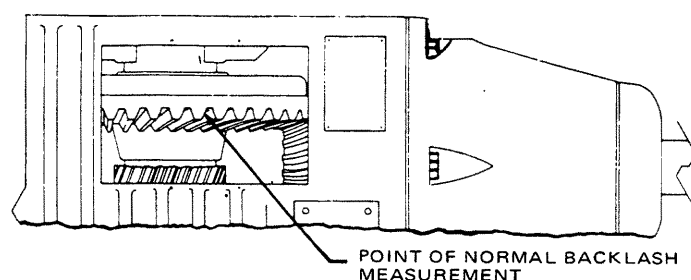


Figure 2. Gear Backlash Measurement

installed through the inspection cover opening. Change shims under top interstage bearing cap until backlash is between .007 to .009" normal to ring gear tooth.

With gears adjusted for proper backlash, blue (Prussian Blue in oil) the gear teeth. Drive the pinion by turning ring gear in both directions for several revolutions. Observe the contact pattern on both gears on both sides of the teeth. The contact pattern should be as shown at the top of Fig. 3.

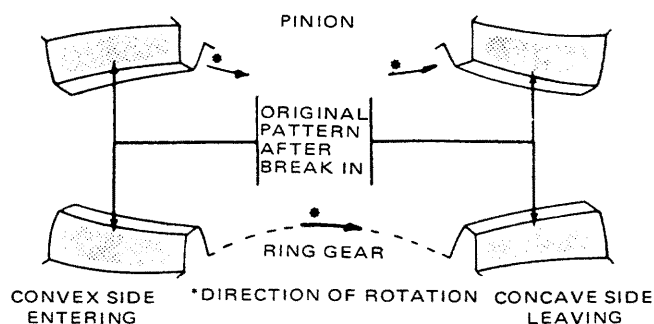
If correct tooth contact pattern is not obtained on first trial, refer to sketches at bottom of Fig. 3; these sketches show the two cases of "out-of-position contact" in the extreme. One of the remedies indicated will correct the out-of-position contact; compare the tooth contact pattern with sketches shown in Fig. 3, and choose the required remedy.

When proper tooth contact has been obtained, recheck the backlash at marked teeth. If it is within the desired range (.007 to .009"), check backlash with dial indicator at 2 additional points 120° apart (with inspection cover removed), and as shown in Fig. 2. All backlash readings must be within the specified range. If backlash is not within the limits, adjust ring gear height with shims until it is, checking again as described.

The tooth contact pattern should again be checked to determine if adjusting the backlash has produced any shift. If it has shifted, move the pinion in the opposite direction the

gear was moved with respect to the cone center. If the gear mounting distance is reduced, increase pinion setting distance, and vice versa, (see Fig. 1, page 4) an amount propor-

### CORRECT PINION & RING GEAR TOOTH CONTACT PATTERNS



### INCORRECT RING GEAR TOOTH CONTACT PATTERN

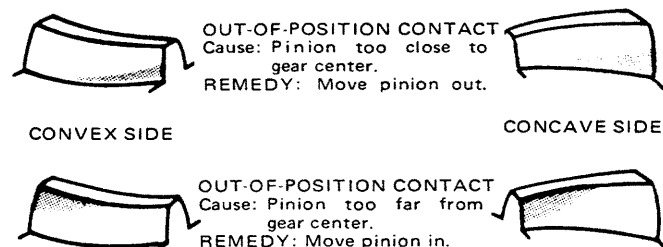


Figure 3. Tooth Contact Pattern, Correct and Incorrect.

tional to the number of teeth in the respective members. For example: on a 10 to 1 gear set, if the ring gear was moved .010", the pinion should be moved 0.001". This would be necessary only if the contact pattern had visually shifted due to movement of the ring gear while adjusting backlash.

When setting a used set of gears, follow the method outlined above. However, depending upon the amount of wear, it may be necessary to set the gears up with slightly greater backlash in order to obtain proper contact. Proper tooth contact pattern is the most important factor of correct installation.

Should a condition be encountered where correct contact cannot be obtained as described in this manual, the Geareducer should be returned to Marley's Olathe, Kansas plant in exchange for a factory reconditioned unit.

## INSTALLATION AND LUBRICATION

The Geareducer must be installed level and properly aligned with the motor shaft. Connect drain line and vent line. Fill Geareducer with recommended oil (Table I) to full mark on case. Refer to Marley Geareducer and Drive shaft service manuals for complete instructions.

## LUBRICANTS FOR MARLEY GEAREDUCERS

To insure maximum performance and service life, Marley Cooling Tower Company recommends Marley factory lubricants be used in all Marley spiral bevel Geareducers. Marley lubricants can be purchased through your local Marley sales office in one-gallon and five-gallon containers.

If lubricants other than Marley factory lubricants are used, they must not contain any additives (such as detergents or EP additives) which are adversely affected by moisture and could reduce the service life of the Geareducer. The responsibility for use of lubricants other than Marley factory lubricants rests with the customer/owner and the lubricant supplier.

Seasonal temperature changes may require one

viscosity of oil for summer operation and another for winter operation. Turbine-type mineral lubricants conforming to the viscosity requirements outlined in Table I may be used. These lubricants will provide service life of up to six months.

Marley Gearlube™ is a premium quality synthesized hydrocarbon lubricant that is specially formulated to deliver extended life without oxidation or loss of lubricity. It is free of undesirable elements that can produce sludge, deposits and corrosion—and a much better extended life lubricant than turbine-type lubricants. Gearlube will provide service life of up to five years and is available in viscosities for all climatic conditions. Approved alternate synthetic lubricants as outlined in Table II may also be used.

| Winter                               | Winter or Summer                    | Summer                               |
|--------------------------------------|-------------------------------------|--------------------------------------|
| Air Temperature at Geareducer        |                                     |                                      |
| Below 32°F<br>(Heat Exchangers Only) | 32°F to 110°F                       | Above 110°F                          |
| <b>SAE 20</b>                        | <b>SAE 30</b>                       | <b>SAE 40</b>                        |
| Viscosity S.U.S<br>at 100°F 230-310  | Viscosity S.U.S<br>at 100°F 450-610 | Viscosity S.U.S<br>at 100°F 750-1000 |

Table I. Turbine-type mineral oil

| Winter                               | Winter or Summer             | Severe Duty/High Temperature |
|--------------------------------------|------------------------------|------------------------------|
| Air Temperature At Geareducer        |                              |                              |
| Below 32°F<br>(Heat Exchangers Only) | 32°F to 110°F                | Above 110°F                  |
| <b>Marley Gearlube SAE30</b>         | <b>Marley Gearlube SAE30</b> | <b>Marley Gearlube SAE40</b> |
| Mobil SHC 629                        | Mobil SHC 629                | Mobil SHC 630                |

Table II. Synthetic oil.

**The Marley  
Cooling Tower  
Company**  
5800 Foxridge Drive  
Mission, KS 66202  
913 362-1818

